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| <p>(54) Title: TREATED WOOD FIBER HAVING HYDROPHOBIC AND OLEOPHILIC PROPERTIES</p> <p>(57) Abstract</p> <p>A whole treated wood fiber material is useful, for example, in the drilling industry and as a scavenger for oil. Fiberized alder is a preferred species and it is treated with a chemical such as a nitrogen containing cationic surfactant or a copolymer latex at an approximately .5-50% weight by weight level and preferably within a range of from 2-10%. The chemical adheres to and penetrates the surface of the fibers or bundles of fiber to provide excellent hydrophobic and oleophilic properties. The chemical can be incorporated into a process stream where wood chips are being fiberized in a well known manner, for example, at the outlet of the fiberizing machine under heat and pressure.</p> | | |

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TREATED WOOD FIBER HAVING HYDROPHOBIC AND OLEOPHILIC PROPERTIES

BACKGROUND OF THE INVENTION

This invention relates generally to treated wood fiber and more particularly to wood fiber treated with chemical compositions such as nitrogen containing cationic surfactants and copolymer latexes that make the fiber oleophilic and hydrophobic. The chemically treated fiber is useful
5 as an additive in drilling fluids for seepage control and lost circulation applications. It has also been found to be useful as an additive to drilling fluids designed to sweep the drill cuttings from the hole where it enhances the fluids sweep properties. Yet another drilling application for the treated fiber of the present invention is in the cementing process where the fiber is
10 used as an anti-fluid loss additive in the cementing composition. The treated fiber has also been found useful as an oil scavenger for oil cleanup in water.

In the past, others have proposed the use of and actually used various composite materials for the above-noted applications which included
15 the use of cellulosic fibers. For example, U.S. Patent 2,211,976, issued August 20, 1940, discloses a process for imparting hydrophobic properties to cellulose fibers. U.S. Patents 3,375,888 and 3,629,102, issued April 2, 1968 and December 21, 1971, respectively, disclose the use of fibers, specifically sugar cane fibers (bagasse), in drilling fluids. Treatment processes are
20 disclosed for the cane fibers but chemically treated wood fiber is not suggested as a suitable fiber. U.S. Patent 4,428,843, issued January 31, 1984, discloses the use of treated cellulose fibers (specifically cotton) in materials which are then used to decrease seepage loss or spurt loss in drilling applications. There is no suggestion that chemically treated wood
25 fibers can be used for drilling applications. These patents are incorporated herein by this reference to provide a complete disclosure and background for the present invention.

An additional prior publication that discusses the use of fibrous materials for the control of lost circulation in the drilling of wells is the
30 article by G. C. Howard and P. P. Scott, Jr. entitled "An Analysis and the Control of Lost Circulation" which appeared in Vol. 192 of Petroleum

Transactions, AIME (1951). The disclosure in this published article is also incorporated herein by this reference. Another published article that has disclosures relevant to the use of the present invention is one by J. W. Hawthorne entitled "How to Handle Well-Site Mud Engineering for Best Efficiency" appearing in the October 22, 1979 issue of the Oil and Gas Journal, which disclosure is likewise incorporated herein by this reference. Yet another such article is one by J. L. Lummus appearing in the November 1967 issue of Petroleum Engineer entitled "A New Look at Lost Circulation." This disclosure is also incorporated herein by this reference.

The problem with the various fibrous materials used for seepage control, as a lost circulation fluid additive, other uses in drilling fluids and as oil scavengers has been generally their high cost and lack of consistent availability. In addition, the use of cotton fiber, since it is a relatively small fiber, requires large quantities thereby increasing cost. The assignee of the present invention has been manufacturing industrial whole wood fibers of predetermined size ranges for many years and has conducted research in the area of adapting its wood-fibers with chemical treatments for use in the oil industry. One such whole wood fiber product that is presently manufactured and sold is sold under the trademark Silva-Fiber which is fiberized alder wood which is treated with a dye to provide coloring. The fibrous material is packaged in bags and sold, for example, to ground mulch applicators. This treated fiber is then sprayed as a slurry or otherwise distributed over ground areas. As an example seeds can be added to the fibrous material, thereby allowing an application to seed an area as well.

Whole wood fiber is a long relatively strong fiber and with a relatively large surface area but it is a water wettable material and without being treated would not provide suitable properties for use as an additive to drilling fluids, cements, or for oil scavenging. After significant work, the properly sized treated whole wood fiber of the present invention was developed, tested and has been found to provide excellent properties and at a reasonable cost for the above related end uses. After the treated wood fiber is manufactured it can be easily packaged in bags and shipped to distributors or directly to end users. In the field, the treated wood fiber is preferably fluffed up and added to the drilling fluids. When used as an oil sorbent, the fiber can simply be spread over the oil spill and then collected.

Accordingly, from the foregoing, it is an object of the present invention to provide a relatively inexpensive, readily available fibrous material useful as an oil absorbent and as an additive to drilling fluids or other fluids used in the drilling industry.

5 A further object is to provide the treated wood fibrous material in a manufacturing process that is readily available, thereby not significantly increasing costs.

These and other objects of the present invention will become more apparent upon reading the specification to follow.

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SUMMARY OF THE INVENTION

Briefly stated the present invention is practiced in one form by a wood fiber, preferably fiberized alder wood, that has been treated with a chemical selected from a group at least comprising copolymer latexes and
15 nitrogen containing cationic surfactants. The preferred treatment is with the chemical at approximately a 2-10% weight by weight level to give the fibrous material excellent hydrophobic and oleophilic properties. The fiberized alder should ideally be uniformly coated and preferably penetration of the fiber surfaces occurs. The chemical is selected for the
20 desirable end properties of increasing oil wettability and decreasing water absorptivity of the fibers.

DESCRIPTION OF THE PREFERRED EMBODIMENT

One abundant wood species growing in the Pacific Northwest is
25 red alder (*Alnus rubra*) which is a hardwood species. Fiberized alder wood has been commercially manufactured and sold for many years for various end uses and has been treated with various chemicals to afford certain desirable end use properties. There are many commercially available processes for producing a fiberized form of alder or other wood fibers and
30 one such process is presently in use by the assignee of the present invention at its manufacturing facility located at Snoqualmie, Washington. While the basic fiberizing process is well known, it will be briefly described here in order to provide a disclosure of a suitable wood fiberizing process.

Usually alder wood chips will be produced from alder logs and
35 the chips represent the raw material. The chips are preheated with steam under pressure and then directed to a refiner which is usually a mechanical

device that grinds the chips to break them down into individual fibers or fiber bundles. The refiner is adjustable to provide fiber size control. Once the chips are broken into fibrous material they will flow through an orifice into a blow line where the fibrous material is under lower pressure. The fibrous material is then passed through drying means such as a dryer tube or conduit after which it is directed to a cyclone separator where the fine fibrous material will be separated from the coarse material. The coarse material is directed to another refining station to further break the coarse material down in a controlled manner into smaller fibrous material. Additional heating and drying may be performed and dust particles separated out and the acceptable fibrous material recombined just prior to bagging the now fiberized and classified wood fiber material.

The present invention concerns adding to a suitable fiberized wood a selected chemical that will become attached to and actually penetrate the surface of the fiberized material to provide hydrophobic and oleophilic properties to the fiber. It has been found that one suitable commercially obtainable nitrogen containing cationic surfactant is available from AKZO Chemie, Inc. as product AC 1715 which is sold in solid flaked form. Within this group of suitable cationic surfactants will be quaternary amine salts, amine salts, polyamines and amides of a molecular weight 200-800. The AKZO surfactant material is heated to 90°C and it has been found that after it has melted, it can be pumped as a liquid and injected into the process line at the outlet of the first fiberizing machine in the process. Since the process flow is under pressure, the liquid surfactant will be relatively uniformly dispersed and will ideally be uniformly distributed over the surface layers of substantially all of the individual fibers or fiber bundles and in fact, given the pressure, penetration into the surface layers of the fibers occurs. It has been found that to produce the treated wood fiber with the desired properties that approximately 0.5-50% by weight on an oven dry wood weight basis of surfactant material should be added to the process flow of fiberized wood. The preferred range is from 2-10%. At the point of addition, the fiber is still wet and this fact enhances the distribution and penetration of the surfactant on the fibers. After adding the surfactant composition, it will remain adhered to the fibers throughout the remainder of the manufacturing and packaging process and therefore will, when the packaged fibrous product is used, provide the desired

oleophilic and hydrophobic properties for the fiber. It is also contemplated that the treated whole wood fiber could be converted into other forms such as mats and pellets, or the like.

5 A commercially available copolymer latex that has been found to provide the wood fibers with the desired oleophilic and hydrophobic properties is obtainable from Walker Brothers, a division of The Glidden Company (Canada) Limited, located in Burnaby, British Columbia as product T-1072 Timberpel E. Timberpel E is a proprietary combination of a paraffin wax emulsion and a styrene butadiene copolymer latex and is sold as a 40%
10 by volume aqueous emulsion. In treating the fiberized wood with this particular copolymer latex it was found that a suitable treating process included blending the aqueous emulsion with the wood fiber in a typical mechanical wood fiber blender. Again, the intent is to coat the surfaces of the wood fibers or fiber bundles with the composition to impart the
15 oleophilic and hydrophobic properties that are desired. The same application rate as with the AKZO chemical surfactant was found to yield excellent properties.

According to normal usage rates in the oil drilling industry, it is common to add anywhere from 2-10 pounds by weight of treated fibrous
20 material for each barrel of fluid before the fluid is pumped into the bore hole. As a treated fibrous additive to a circulation fluid, it functions to seal permeable formations and to fill and seal fractures and the like within the bore hole wall. When used as a sweep additive, it will be added to the circulating drilling fluid in an amount sufficient to increase the effective
25 viscosity of the fluid, thus aiding the removal of the cuttings. When the treated fibrous material is used as an oil scavenger, it is simply blown or otherwise distributed over a body of water where oil has been spilled and the fibrous material will float on the water both before and after having absorbed oil. The oil carrying treated fiber can then be subsequently
30 collected and properly disposed.

A detailed description has been given of the treated whole wood fiber useful in drilling applications and as an oil scavenger. It may occur to those skilled in the art to make changes and modifications; however, all such changes and modifications are intended to be included within the scope of
35 the appended claims.

CLAIMS

1. A whole wood fiber of the type prepared by fiberizing wood and having a relatively large surface area, the improvement comprising:
a chemical treatment applied to the fiber to make the fiber hydrophobic and oleophilic.
- 5 2. A wood fiber as in claim 1 treated with a chemical selected from a group at least comprising copolymer latexes and nitrogen containing cationic surfactants.
3. A wood fiber as in claim 1 or 2 in which the chemical is applied on an oven dry wood weight basis of from .5-50%.
- 10 4. A wood fiber as in claim 1, 2 or 3 in which the chemical is, at least in part, penetrating the surface of the fiber.
5. A wood fiber as in claim 3 in which the chemical is applied on an oven dry wood weight basis of from 2-10%.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US88/02122

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶

According to International Patent Classification (IPC) or to both National Classification and IPC

INT. CL. 4 B27K 3/00

US CL. 162/157.1, 164.6, 182

II. FIELDS SEARCHED

Minimum Documentation Searched ⁷

Classification System

Classification Symbols

US

162/157.1, 164.6, 182
428/361, 375

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched ⁸

III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹

| Category ¹⁰ | Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹² | Relevant to Claim No. ¹³ |
|------------------------|--|-------------------------------------|
| Y | US, A, 4,428,843 (OWAN) 31 JANUARY 1984; ENTIRE COLUMN 2. | 1-5 |
| <u>Y</u> X | US, A, 4,584,357 (HARDING) 22 APRIL 1986; ALL EXAMPLES | <u>1-5</u> 1-5 |
| <u>Y</u> X | CA, A, 461,850 (DANIEL) 20 DECEMBER 1949 COLUMNS 6-8. | <u>1-5</u> 1-5 |

* Special categories of cited documents: ¹⁰

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"G" document member of the same patent family

IV. CERTIFICATE

Date of the Actual Completion of the International Search

03 AUGUST 1988

International Searching Authority

ISA/US

Date of Mailing of this International Search Report

07 SEP 1988

Signature of Authorized Officer

W. J. VANRAIJN

